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Contra  
Costa  
County



# PAVEMENT MAINTENANCE NEEDS

PUBLIC WORKS DEPARTMENT MARCH , 1985





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PUBLIC WORKS DEPARTMENT  
CONTRA COSTA COUNTY

DATE: July 16, 1985

TO: Board of Supervisors

FROM: J. Michael Walford, Public Works Director

SUBJECT: Pavement Maintenance Needs Report

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Attached is a report on the pavement preventive maintenance needs of Contra Costa County prepared by the Road Projects Division in conjunction with the Maintenance Division and the Materials Testing Laboratory. It summarizes a five year effort of the Pavement Management Team. During this five year period, we have concentrated on the development of a comprehensive computerized Pavement Management Program. A good knowledge of pavement needs is available. As a result, ten (10) new and modified pavement maintenance techniques and procedures have been tested and over half of them have been adopted as normal departmental operations. This effort has stretched our maintenance dollars and has kept our road system from total collapse. This has not been enough to keep up. The increasing backlog is showing up as rapidly deteriorating roads, unsightly cracks and potholes. The lack of preventative maintenance is undermining the health and integrity of our roads.

Preventative maintenance comprise 27 percent (\$2 million) of the total maintenance budget for roads of \$7.3 million in Fiscal Year 1984-85. This Report puts our preventive maintenance needs at \$5.6 million annually, an increase of \$3.6 million annually and indicates that cost increases due to deferring maintenance amounts to 20 percent per year. At the current funding level, the backlog can grow to over \$140 million by the year 1995.

I recommend that the Report be accepted by the Board of Supervisors and referred to the Board's Budget Committee to consider providing a funding source for the preventive maintenance program in the amounts recommended in the Report. It is further recommended that the source of funds be derived from motor vehicle in-lieu tax or sales tax until a stable source of road funds can be developed.

JMW:MS:sf  
PvmtMtceRpt  
Attachment



CONTRA COSTA COUNTY  
PREVENTIVE PAVEMENT MAINTENANCE NEEDS

Report to the Board of Supervisors  
of  
Contra Costa County

July 16, 1985

Public Works Department  
Contra Costa County



**CONTRA COSTA COUNTY  
PREVENTIVE MAINTENANCE STUDY  
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} available  
upon request

**CONTRA COSTA COUNTY  
PREVENTIVE MAINTENANCE STUDY  
1985**

**PURPOSE**

The purpose of this report is to assess the current road pavement preventive maintenance needs and to recommend a program to address those needs.

This report will briefly outline the results of the continuing study by the Public Works Department Pavement Management Team. A detailed five-year action plan is recommended to restore and maintain the integrity of the County Road System.

**EXECUTIVE SUMMARY**

For the last five years, the funding levels for preventive pavement maintenance have been insufficient to maintain many of the roads at a reasonable level of service. Because of the reduced level of maintenance, many roads have deteriorated. Significant rehabilitation or reconstruction is necessary to bring them back to an acceptable condition. The financial need of these roads is classified as "BACKLOG." A listing of the backlog is in Appendix "A".

- The current road pavement "BACKLOG" is \$5.8 million and increasing annually.

Besides addressing the "BACKLOG," the funding of an annual preventive maintenance program is needed to maintain the remaining County road pavements at an acceptable level of service, and to prevent the occurrence of new "BACKLOG." Without such a preventive maintenance program, "BACKLOG" needs could grow to \$140 million by 1995.



- **The annual road pavement preventive maintenance needs are \$5.6 million.**

The current funding level for preventive pavement maintenance is \$2 million, about 27 percent of the total maintenance budget. This amount consists of approximately \$1.5 million of County road revenue and \$500,000 of Federal and State grants annually.

At the current \$2 million annual funding level, many roads are not receiving the appropriate care. Roadways are deteriorating rapidly, riddled with unsightly cracks and dangerous potholes. The longer they are allowed to deteriorate, the more costly the treatment will be to return them to an acceptable level of service. These poor roads will expose the County to higher potential for liability claims and payments.

- **Every \$1 spent today will save \$5.2 dollars in 10 years.**

Recent study by the Metropolitan Transportation Commission indicates that poor pavement conditions are costing the public about \$60 per vehicle per year in terms of additional wear and tear. **This hidden cost is equivalent to 10 cents of tax per gallon of gasoline used.** In Contra Costa County, an additional \$4 million expenditure in preventive pavement maintenance will save the public over \$8.4 million per year.

#### **RECOMMENDATIONS**

It is recommended that the Board of Supervisors:

- COMMIT TO FUNDING AN ADEQUATE PREVENTIVE MAINTENANCE PROGRAM
- SEEK TO ELIMINATE THE "BACKLOG" IN PAVEMENT MAINTENANCE OVER A 10 YEAR PERIOD
- ACTIVELY PURSUE WAYS TO GENERATE ADDITIONAL REVENUE FOR ROAD NEEDS



Recognizing the financial situation of the County, a 10-year \$79.8 million program has been prepared for implementation as shown on Table 1. Under this plan, the recommended outlay for Fiscal Year 1986 will be \$3.5 million and for Fiscal Year 1987, \$5.5 million. This represents a 75 percent and 57 percent annual increase over the previous years appropriation, but will still be short of the amount needed to meet the adequate funding level. Subsequently, annual increases in funding, to a maximum of \$8.5 million in 1988/89 are necessary before the "backlog" begins to reduce. In other words, even with **substantially new funding, the roads will get worse, on an average, for at least four to five more years.**

Presently, all possible funds available for road purposes are being channeled to the preventive maintenance program. To divert additional funds presently utilized for other maintenance and construction works would severely curtail or eliminate necessary activities. Therefore, it is further recommended that the additional funding necessary to achieve the recommended level be obtained, as it was in the past, by utilizing revenues from the general sales tax and the motor vehicle in-lieu tax.

Pavement failure -  
base failures and  
chuck holes.



**TABLE 1**

**TEN-YEAR FUNDING PLAN  
(IN TODAY'S DOLLARS) ‡**

<u>FISCAL YEAR</u>	<u>ANNUAL PAVEMENT MAINTENANCE NEEDS</u>	<u>* BACK- LOG</u>	<u>TOTAL NEEDS</u>	<u>RECOMMENDED FUNDING</u>	<u>UNMET NEEDS</u>
85/86	\$ 5,600	\$ 5,800	\$11,400	\$ 3,500	\$ 7,900
86/87	\$ 5,600	\$ 9,480	\$15,080	\$ 5,500	\$ 9,580
87/88	\$ 5,600	\$11,496	\$17,096	\$ 7,000	\$10,095
88/89	\$ 5,600	\$12,115	\$17,715	\$ 8,500	\$ 9,215
89/90	\$ 5,600	\$11,058	\$16,658	\$ 8,500	\$ 8,158
90/91	\$ 5,600	\$ 9,790	\$15,390	\$ 8,500	\$ 6,890
91/92	\$ 5,600	\$ 8,268	\$13,868	\$ 8,500	\$ 5,368
92/93	\$ 5,600	\$ 6,441	\$12,041	\$ 8,500	\$ 3,541
93/94	\$ 5,600	\$ 4,250	\$ 9,850	\$ 8,500	\$ 1,350
94/95	\$ 5,600	\$ 1,620	\$ 7,220	\$ 7,220	-0-
95/96	\$ 5,600	-0-		\$ 5,600	

\* Back-log equals 1.2 X previous year's carry-over

‡ All amounts are in thousands of dollars



## DISCUSSION

### - The evolution of the County Road System.

The dusty wagon trails of the past were eventually oiled to control dust, graded to improve the drainage and ruts, and finally gravelled to provide durability. Additional applications of oil and rock produced the first seal coat pavements which became the backbone of the County road system; they evolved to a reasonable level of serviceability by responding to obvious needs.

In subsequent years, these roads and the "bond issue" roads of the mid-50's were designed and constructed based on the recognized design standards at that time. The rapid urbanization of the County and, with it, the increase in truck and automobile traffic and the natural aging process has made these roads structurally inadequate to provide reasonable service demanded for modern day vehicles and loads.

The post Proposition 13 era led to great cutbacks in the Road program through the diversion of needed funds to other purposes in County government. When rehabilitation funds were most needed, they were not available. **PAVEMENTS CONTINUED TO DETERIORATE AT AN EVER INCREASING RATE.**

### **WHY PAVEMENT MANAGEMENT?**

Not too many years ago, typical maintenance procedures called for a major rehabilitation (asphalt concrete overlay) every 20 years, and reconstruction when the road grade becomes too high relative to the adjacent improvements. This process has two major disadvantages. The first is that between successive overlays, the condition of the pavement will deteriorate to a very undesirable condition. The second is the higher cost of such a program.

It is estimated that implementation of this program it will cost the County \$7.2 million a year.

Pavement Management is an alternative to the previous approach. By combining research results, field observations and factors such as traffic, soil conditions, rainfall and temperature, cracking, ride comfort, potholes, surface wear and others, the RATE and MANNER at which the pavement is deteriorating may be forecast. Using this information, a recommended course of action can be selected to maintain the pavement at an acceptable level of service at minimum cost.

Figure 1 shows the theoretical model of pavement failure. The relationship between pavement condition, represented by the pavement serviceability index and age is shown. As pavement deteriorates over the years, the index drops from good - to marginal - to unacceptable. During this period, certain pavement treatments as shown on Tables 2 and 3 are applied. The cyclic method recommended, shown on the sample roadway of Figure 1a, is less costly over the years and consistently provides higher average serviceability than the historic approach (Fig. 1b). The difference in cost between the two methods is approximately \$1.4 million annually.

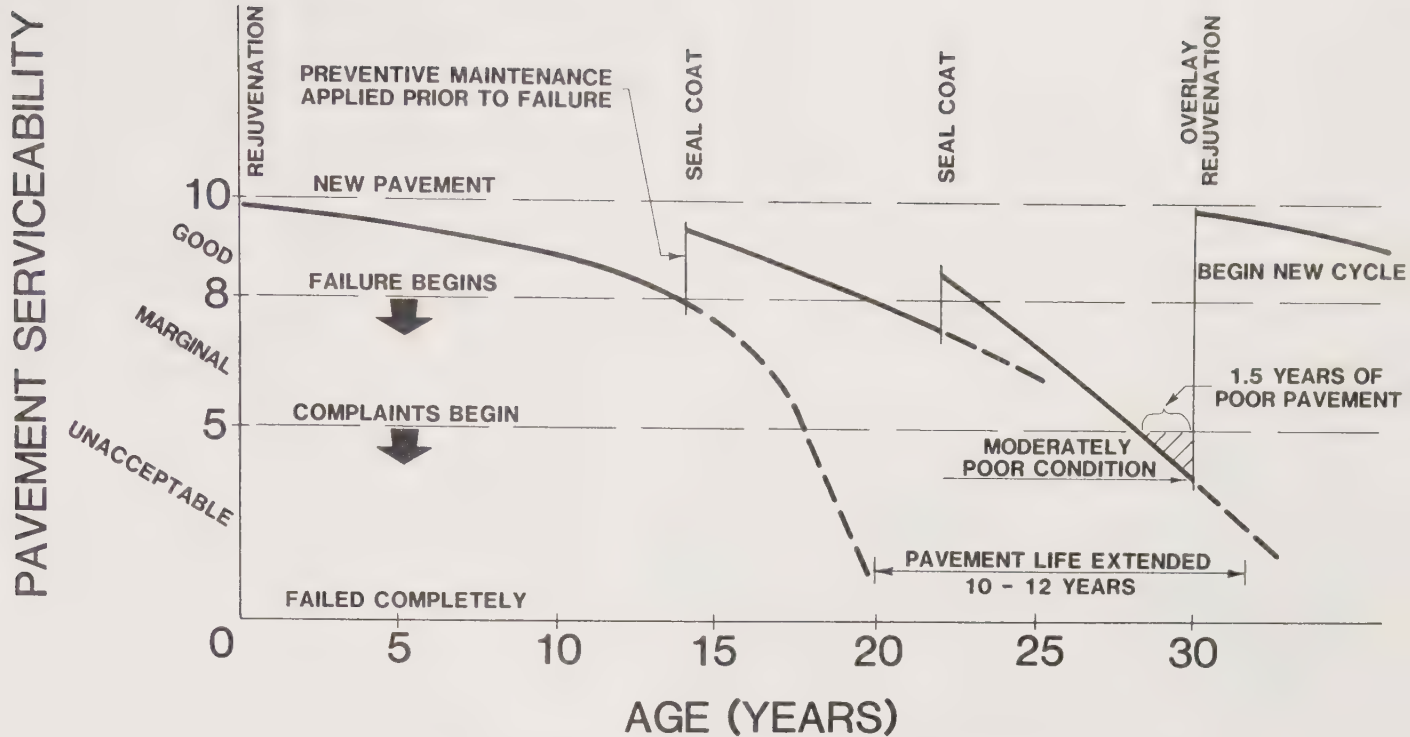
Pavement failures -

Traffic induced

base failures.

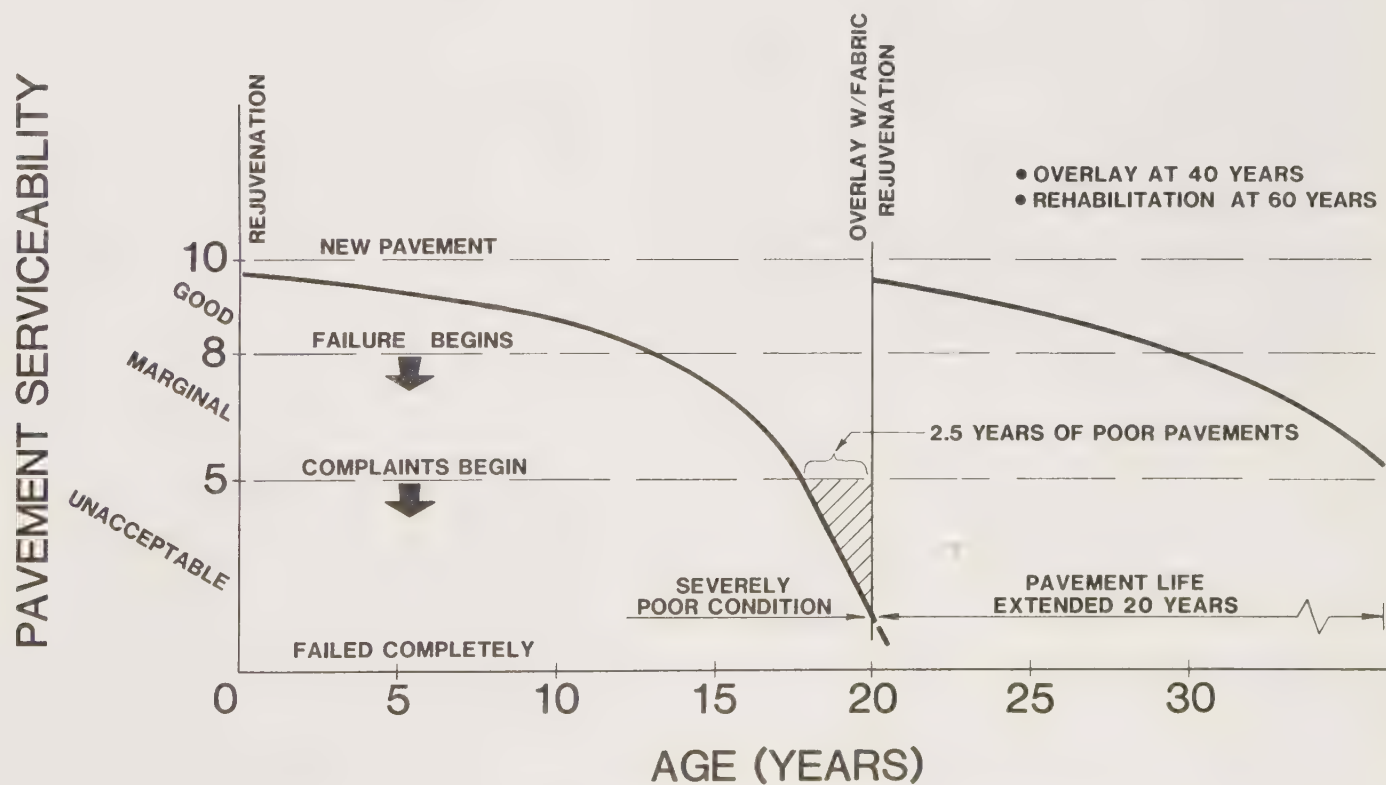






## TYPICAL LOCAL ROAD

FIG. 1A RECOMMENDED PAVEMENT MANAGEMENT  
COST \$0.25 PER SQ. YARD PER YEAR  
AVERAGE SERVICEABILITY 8.20



## TYPICAL LOCAL ROAD

FIG. 1B HISTORIC TREATMENT PLAN  
COST \$0.31 PER SQ. YARD PER YEAR  
AVERAGE SERVICEABILITY 8.10





## **MAINTENANCE VS. PREVENTIVE MAINTENANCE**

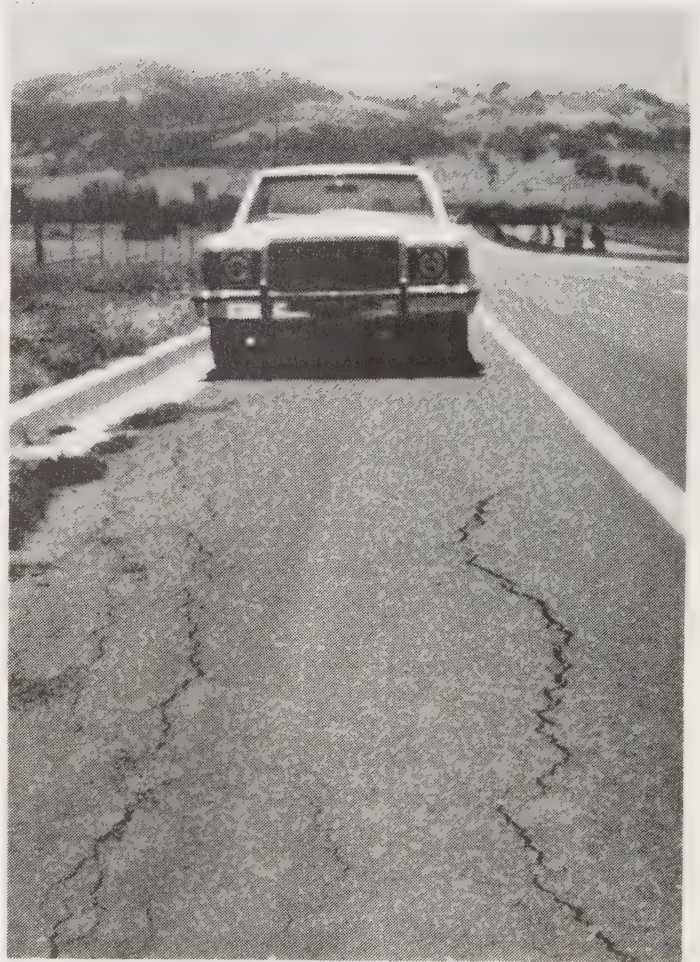
ORDINARY Maintenance Operations are all the other activities accomplished by the Road Maintenance Division, such as storm damage repair, shoulder and drainage maintenance, painting and striping, signs, and related activities. The costs for these facets are not included in the following discussions. It should be noted, they too are funded at less than acceptable levels.

Pavement maintenance is divided into two categories: CORRECTIVE (or reactive) and PREVENTIVE. Corrective maintenance is applied to obvious problems, such as potholes and rough roads, and occasionally is done to hold roads together ("bandaid") until sufficient money is available for proper rehabilitation. Preventive maintenance is done to extend pavement life and to prevent problems from occurring in the first place.

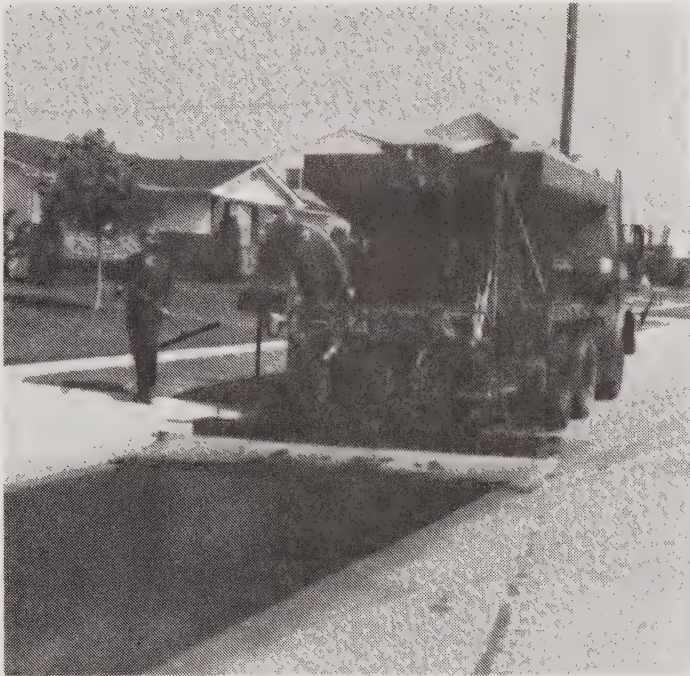
The Pavement Management System allows the Public Works Department to choose and apply strategies of a variety of road treatments in a timely manner, to ensure maintaining pavements at an acceptable level and at lower costs. Currently, little of the available funding is directed toward true preventive maintenance. Reaction to obvious problems is the necessary course of action.

### **PREVENTIVE MAINTENANCE**

An actual preventive pavement maintenance program using cost effective techniques will reduce annual cyclic maintenance costs. The results will be the timely and cost effective surface treatment resulting in the elimination of the costly "bandaid" approach to road repair, the reduction of the vehicular operating cost to the motorist, and the reduction of potential liability claims against the County.



Cracking



Slurry Seal

In order to establish the acceptable level of service, in addition to the measured properties of the pavement discussed, the magnitude and the number of complaints from the public is a factor. An evaluation of the County's liability is also considered. This analysis results in condition categories of **good**, **marginal** and **unacceptable** roads, and the roads themselves are categorized by function as **major arterial/industrial**, **minor arterial/collector**, and **local**. Various maintenance strategies are assigned to each type of road based on the existing pavement condition. The type and cyclic application of the various treatments is shown in Table 2. The related costs (Table 3) are averaged for the usual application, including preparation and engineering costs where applicable.

Rehabilitation of major arterials and truck routes is anticipated, on the average, every 45 years and every 60 years for minor arterials, collectors and local roads.

#### **AVERAGE ANNUAL COST OF PREVENTIVE MAINTENANCE**

The average annual cost of pavement preventive maintenance using the recommended cyclic treatment programs varies according to the function of the road. The roads are grouped into three categories. There are numerous maintenance strategies from which to choose.

The overall cost is based on the cyclic treatments and costs identified in Tables 2 and 3 for each functional type of road and pavement treatment for the current County road system of 853 miles.

<u>FUNCTIONAL TYPE OF ROAD</u>	<u>ANNUAL CYCLIC COSTS</u>
Major Arterials and Industrial Routes	\$2,300,000
Minor Arterials and Collectors	2,020,000
Local Roads	<u>1,280,000</u>
Average Annual Cost Total	\$5,600,000



TABLE 2

**RECOMMENDED CYCLIC TREATMENTS  
FOR THE LIFE OF A PAVED ROAD**

<u>YEAR AFTER INITIAL CONSTRUCTION LIFE</u>	<u>MAJOR ARTERIALS AND TRUCK ROUTES</u>	<u>MINOR ARTERIALS AND COLLECTORS</u>	<u>LOCAL ROADS</u>
0	Newly built	Newly built	Newly built
1	Rejuvenation	Rejuvenation	Rejuvenation
2			
4			
6	Rejuvenation	Rejuvenation	Rejuvenation
8			
10			
12			
14	Seal coat	Seal coat	Seal coat
16			
18			
20	A.C. overlay	A.C. overlay	
21	Rejuvenation	Rejuvenation	
22			Seal coat
24			
26	Rejuvenation	Rejuvenation	
28			
30			A.C. overlay
31			Rejuvenation
32			
34		Seal coat	
36	Seal coat		Rejuvenation
38			
40		A.C. overlay	
41		Rejuvenation	
42			
44			Seal coat
45	Rehabilitation		
46	Rejuvenation	Rejuvenation	
48			
50			
52	Rejuvenation		Seal coat
54		Seal coat	
56			
58			
60	Seal coat	Rehabilitation	Rehabilitation

\* Rehabilitation includes both complete and partial reconstruction

**TABLE 3**

**ANNUAL COST TO MAINTAIN COUNTY ROAD PAVEMENTS**

	MAJOR ARTERIALS AND TRUCK ROUTES		MINOR ARTERIALS AND COLLECTORS			LOCAL ROADS	
Traffic Characteristics	Heavy		Medium			Light	
	(TI 7.5)		(7.5 TI 5.5)			(5.5 TI)	
Total Square Yards	3,382,000		4,927,000			5,120,000	
<u>TREATMENT \$/SQ. YD.</u>							
Rehabilitation (1)	\$	18.67	\$	9.90		\$	8.00
Overlay (2)	\$	8.80	\$	5.40		\$	3.60
Seal Coat (3)	\$	1.10	\$	0.86		\$	0.58
Rejuvenation (4)	\$	0.28	\$	0.28		\$	0.28
Total Cost per sq. yard per year	\$	0.68	\$	0.41		\$	0.25
Cost per year	\$	2,300,000	\$	2,020,000		\$	1,280,000

(1) Includes 15% of cost for engineering charges; 10% of roads total reconstruction, 90% of roads pavement replacement.

(2) Includes 15% of cost for pavement preparation and grinding along gutter.

(3) Includes 15% of cost for pavement preparation.



Rejuvenation

(oil treatment)



## CURRENT BACKLOG

Because of the diminished funding levels prevalent over the last several years, the condition of some roads have degraded to the extent that routine cyclic treatment will no longer suffice to restore and maintain an acceptable level of service. This type of road is listed in the BACKLOG category and requires reconstruction or significant rehabilitation to provide adequate service. The current BACKLOG totals \$5.8 million and is listed in Appendix "A".

There are an additional 12 roads listed in Appendix "B" which would cost another \$5.8 million to reconstruct which are not listed as BACKLOG. Termination of maintenance on these roads will be recommended at a later date and therefore they were not included.



CHIP SEAL COAT OPERATIONS  
OIL DISTRIBUTOR  
CHIP SPREADER  
ROLLERS (2)  
ROCK TRUCKS

## FUNDING ALTERNATIVES AND THEIR RESULTS

1. Eliminate Backlog Over 10 Years (Table 1) - **The RECOMMENDED ALTERNATIVE** is to gradually reduce the BACKLOG and proceed with a full cyclic preventive treatment program. The sooner the BACKLOG is eliminated, the more cost effective the program. But since an additional \$9.4 million is not likely to be available for fiscal year 1985/86, a 10-year \$79.8 million program is recommended. (Table 1) The funding would start at \$3.5 million and increase to \$8.5 million in four years. A reduction to \$5.6 million annually is expected upon completion of the backlog work, 10 years hence.
2. Eliminate Backlog Now - Funding preventive maintenance and the entire backlog in total amount of \$11.9 million this year will eliminate the costly increase due to deferment and immediately improve the overall condition of the roads. This approach will reduce the 10-year program to \$61.8 million, but such a program is impractical to fund and all but impossible to construct in one year.
3. Continue Present Funding Level (Table 4) - The current funding level of \$2 million a year (\$20 million in 10 years) for pavement maintenance is not enough to keep up with the cyclic treatment and reduce the backlog. At that level it is estimated that there will be \$140 million worth of roads which will need reconstruction or major rehabilitation with 10 years (Table 4). With the roads in a state of disrepair, the results would be increased routine maintenance costs to "pothole" streets, poor ride, increased user complaints and costs (vehicle maintenance) and increased liability payments.
4. Maintain Constant Backlog Level (Table 5) - This method requires an immediate increase in annual funding of \$4.57 million, which rate is insufficient to overtake the deterioration rate. Hence, the average road condition now existing would not be improved.



Rehabilitation (Reconstruction)



**TABLE 4****PRESENT FUNDING LEVEL  
(IN TODAY'S DOLLARS) ‡**

<u>Fiscal Year</u>	<u>Program Pavement Maintenance</u>	<u>* Backlog</u>	<u>Total Needs</u>	<u>Current Funding</u>	<u>Unmet Needs</u>
85/86	\$ 5,600	\$ 5,800	\$ 11,400	\$ 2,000	\$ 9,400
86/87	\$ 5,600	\$ 11,280	\$ 16,880	\$ 2,000	\$ 14,880
87/88	\$ 5,600	\$ 17,856	\$ 23,456	\$ 2,000	\$ 21,456
88/89	\$ 5,600	\$ 25,747	\$ 31,347	\$ 2,000	\$ 29,347
89/90	\$ 5,600	\$ 35,217	\$ 40,817	\$ 2,000	\$ 38,817
90/91	\$ 5,600	\$ 46,580	\$ 52,180	\$ 2,000	\$ 50,180
91/92	\$ 5,600	\$ 60,216	\$ 65,816	\$ 2,000	\$ 63,816
92/93	\$ 5,600	\$ 76,579	\$ 82,179	\$ 2,000	\$ 80,179
93/94	\$ 5,600	\$ 96,215	\$101,815	\$ 2,000	\$ 99,815
94/95	\$ 5,600	\$119,778	\$ 13,378	\$ 2,000	\$123,378
95/96	\$ 5,600	\$140,054	\$153,654	\$ 2,000	\$151,654

\* Backlog equals 1.2 x previous year's carryover

‡ All amounts are in thousands of dollars

**TABLE 5**  
**CONSTANT BACKLOG FUNDING LEVEL   #**

<u>Fiscal Year</u>	<u>Program Pavement Maintenance</u>	<u>* Backlog</u>	<u>Total Needs</u>	<u>Constant Funding</u>	<u>Unmet Needs</u>
85/86	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
86/87	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
87/88	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
88/89	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
89/90	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
90/91	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
91/92	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
92/93	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
93/94	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
94/95	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833
95/96	\$ 5,600	\$ 5,800	\$ 11,400	\$ 6,567	\$ 4,833

\* Backlog equals 1.2 x previous year's carryover

# All amounts are in thousands of dollars



## **PROPOSED CYCLIC TREATMENT PROGRAMS (THE FIVE-YEAR ACTION PLAN)**

Based on the recommendation funding level identified in Table 1, a summary of the costs and types of treatments is listed in Appendix "C" for the next five years. The continued use of this funding plan will eliminate the backlog in 10 years, at which time the funding level to maintain high quality service may be reduced to \$5.6 million annually.

## **ROAD CONDITION AND TREATMENT SUMMARY**

Appendix "D" contains a listing obtained from the Pavement Management Program showing all County roads by alphabetical listing, road condition, next treatment and anticipated year.

It should be noted that all data in this report is based on statistical analyzes and may be subject to change, particularly road treatment and date.





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